

## Scientific Inquiry

**PS-1 The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.**

**PS-1.6 Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.**

**Taxonomy Level:** 5.1-B Evaluate Conceptual Knowledge

### Key Concepts:

controlled scientific investigation

hypothesis

**Previous/Future knowledge:** Students planned and conducted controlled scientific investigations beginning in the 5<sup>th</sup> grade (5-1.3). They evaluated results to formulate valid conclusions beginning in the 5<sup>th</sup> grade (5-1.6), and they generated questions to formulate a hypothesis (5-1.1). In Physical Science, students are introduced to testing a hypothesis by designing a controlled scientific investigation (PS-1.4) and organizing and interpreting data by using mathematics, graphs, models, and technology (PS-1.5). In chemistry (C-1.6) students will expand their knowledge of scientific investigation by including what the possible sources of error might be. In physics (P-1.9) students will communicate and defend a scientific argument or conclusion.

### It is essential for students to-

- Understand that in a controlled scientific investigation the *hypothesis* is a prediction about the relationship between an independent and dependent variable with all other variables being held constant.
- Understand that results of a controlled investigation will either refute the hypothesis or verify by supporting the hypothesis.
  - After the hypothesis has been tested and data is gathered, the experimental data is reviewed using data tables, charts, or graphical analysis.
  - If the data is consistent with the prediction in the hypothesis, the hypothesis is supported.
  - If the data is not consistent with the prediction in the hypothesis, the hypothesis is refuted.
- Understand that the shape of a graph can show the relationship between the variables in the hypothesis. (See graph shapes in PS-1.5)
- Understand that if the data does support the relationship, the hypothesis is still always tentative and subject to further investigation. Scientists repeat investigations and do different investigations to test the same hypothesis because the hypothesis is always tentative, and another investigation could refute the relationship predicted.
- Understand that scientific laws express principles in science that have been tested and tested and always shown to support the same hypothesis. Even these laws, however, can be shown to need revision as new scientific evidence is found with improved technology, advanced scientific knowledge, and more controlled scientific investigations based on these.

### It is not essential that students

- Develop new hypotheses if the results have refuted the tested hypothesis;
- Carry out statistical analysis on the collected data.

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### Assessment Guidelines:

The objective of this indicator is to evaluate results of a controlled scientific investigation in terms of whether they refute or verify/support the hypothesis, therefore, the major focus of the assessment should be to critique the data (tables, charts, and graphical analysis) from an investigation to determine if the results support the relationship predicted between variables in the hypothesis.

In addition to *evaluate*, assessments may require that students:

- Infer that a hypothesis is verified or refuted by the results of the investigation;
- Compare data that supports or refutes a hypothesis;
- Explain why the results of an investigation support or refute a hypothesis;
- Analyze the data from an investigation to see if it supports or refutes the hypothesis.